Running head: RESPONSE PERSEVERATION AND BOLDNESS

Response Perseveration and the Triarchic Model of Psychopathy in an Undergraduate Sample

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Abstract

This study aimed to extend previously reported links between distinctive configurations of traits in the psychopathic personality and maladaptive response perseveration, by examining performance in the Card Perseveration Task (CPT) within the framework of the triarchic model of psychopathy in a mixed-gender undergraduate sample. A computerized version of the CPT was administered to 222 undergraduates (142 women) assessed for triarchic psychopathy dimensions using the Triarchic Psychopathy Measure (TriPM). Maladaptive response perseveration (more cards played and less money earned) was uniquely associated with trait boldness scores for both women and men. Moreover, analyses of response times following feedback indicated that poor performance on the CPT was related to lack of overall reflection. Further mediation analyses did not reveal significant effects of trait boldness on the response perseveration deficit through reflection times. Our results provide new evidence for the role of trait boldness in the failure to suspend reward-approach behavior in the face of increasing punishment contingencies, probably due to an absence of fear or insensitivity to punishment cues rather than to an unreflective response style.

Keywords: Triarchic model of psychopathy, response perseveration, Card perseveration task, Boldness

Laboratory studies have consistently shown that psychopathic individuals have deficits in inhibiting responses that result in punishment (Lykken, 1957; Newman & Kosson, 1986; Newman, Patterson, & Kosson, 1987; Siegel, 1978). Prominent etiological models of psychopathy have offered alternative accounts of this perseverative response, emphasizing either a lack of normal fear reactivity/insensitivity to punishment cues (Lykken, 1957, 1995) or a failure of response modulation (Newman, 1998). According to the response modulation hypothesis, psychopathic individuals do show unresponsiveness to punishment cues only when this information is secondary to their dominant response set. In such contexts, they fail to switch their attentional focus from their ongoing goal-directed behavior to the feedback, thus potentially leading to response perseveration (Hamilton & Newman, 2018; Newman, 1998; Patterson & Newman, 1993). Response perseveration has been operationalized in laboratory settings via the Card Perseveration Task (CPT; Newman et al., 1987), which measures the ability of participants to extinguish a previously rewarded response as the rate of punishments gradually outweighs the rate of rewards throughout the task. Psychopaths' maladaptive response perseveration in the CPT —more cards played and less money earned— has been replicated in past research using the Hare Psychopathy Checklist-Revised (PCL-R; Hare, 1991, 2003) to assess psychopathy in incarcerated samples of men (Moltó, Poy, Segarra, Pastor, & Montañés, 2007; Newman et al., 1987), though not of women (Vitale & Newman, 2001).

A multifaceted, instead of unitary, conceptualization of psychopathy (see Skeem, Polaschek, Patrick, & Lilienfeld, 2011) could help to understand the extent to which psychopathy-related response perseveration deficits generalize from men to women, as well as to shed light on its underlying mechanism. Emphasizing the multifaceted nature of this personality disorder, the triarchic model (Patrick, Fowles, & Krueger, 2009) offers an integrative framework of the alternative historical and contemporary conceptualizations of psychopathy, which are organized around three distinct dispositional constructs: *Boldness* —

entailing social dominance, emotional resiliency, venturesomeness and tolerance for uncertainty—, *Meanness* —encompassing features such as deficient empathy, lack of affiliative capacity, callousness and exploitativeness—, and *Disinhibition* —entailing impulsivity, nonplanfulness, impaired regulation of emotion and urges, and weak behavioral restraint (Patrick et al., 2009). Although the triarchic model focuses on the description of the distinct dispositional manifestations of psychopathy, it also advocates considering the differing neurobiological and developmental processes contributing to them (Fowles, 2018; Patrick, 2018; Patrick & Drislane, 2015; Patrick et al., 2009).

In this regard, and based on evidence demonstrating divergent associations between the affective/interpersonal and the impulsive/antisocial features of psychopathy and relevant criterion measures in multiple measurement domains, dual-process models have emerged to challenge unitary etiological models of psychopathy, and to posit instead that there are, *at least*, two separable etiological processes contributing to the differing symptomatic features of this personality disorder (for reviews, see Fowles & Dindo, 2006, 2009; Patrick & Bernat, 2009). From a neurobiological standpoint (Patrick & Bernat, 2009) the first process, named *'trait fearlessness'*, involves a weakness in defensive (fear) reactivity, implicating the amygdala and affiliated structures, and is more relevant to understand the dispositional dimensions of boldness and (perhaps to a lesser degree) meanness in the triarchic model (see Patrick & Drislane, 2015; Skeem et al., 2011). The impulsive/antisocial features of psychopathy —represented in the disinhibition dimension of the triarchic model (Patrick & Drislane, 2015; Skeem et al., 2011)— are believed to arise from a second process, named *'externalizing proneness'*, which presumably reflects impairments in frontocortical systems mediating executive control functions involved in the adequate regulation of behavioral and affective reactions, and that constitutes a liability factor common to diverse impulse control disorders (Fowles & Dindo, 2006, 2009; Patrick & Bernat, 2009).

Evidence relating perseverative deficits and distinctive configurations of traits in the psychopathic personality is mixed. On the one hand, maladaptive response perseveration has been specifically linked to the impulsive/antisocial features of psychopathy in incarcerated men (Moltó et al., 2007), consonant with worse performance on the CPT in noninstitutionalized adult men exhibiting antisocial behavior problems (Belmore & Quinsey, 1994) and in individuals representing a wide range of conditions within the externalizing spectrum (see Krueger et al., 2002; Young, Stallings, Corley, Krauter, & Hewitt, 2000) — including boys and girls with conduct disorder (Daugherty & Quay, 1991; Fonseca & Yule, 1995; Shapiro, Quay, Hogan, & Schwartz, 1998), boys with conduct disorder with comorbid ADHD (Matthys, van Goozen, de Vries, Cohen-Kettenis, & van Engeland, 1998), boys with oppositional defiant disorder (Matthys, van Gonzen, Snoek, & van Engeland, 2004), boys with a history of physical aggression (Séguin, Arseneault, Boulerice, Harden, & Tremblay, 2002), pathological gamblers (Goudriaan, Oosterlaan, de Breus, & van den Brink, 2005; Thompson & Corr, 2013), and adolescents with substance dependence symptoms (Martin, Rayens, Kelly, Hartung, & Leukefeld, 2000).

On the other hand, several other studies have reported response perseveration for clinic-referred children showing high levels of callous-unemotional (CU) traits (akin to meanness in the triarchic model; Patrick et al., 2009) either irrespective of, or in addition to, their conduct problem diagnoses (Barry et al., 2000; Fisher & Blair, 1998; O'Brien & Frick, 1996). Importantly, CU traits have also been related to response perseveration in non-referred children even in the absence of severe conduct problems (Frick et al., 2003). These findings, together with other work showing diminished emotional responding to fear and others' distress, as well as higher levels of fearless and thrill seeking traits, are indicative of a fearless temperament contributing to the emergence of CU traits (Frick, Ray, Thornton, & Kahn, 2014, for a review). From a developmental perspective, this low-fear pathway (cf. Fowles & Dindo, 2009) is hypothesized to contribute to both boldness and meanness dimensions in the

triarchic model, depending on its interactions with other developmental factors (Fowles, 2018).

Another key aspect in considering the mechanisms leading to maladaptive response perseveration might be related to the amount of time participants pause and reflect after receiving feedback. Newman et al. (1987) showed that the perseverative deficits of psychopaths were abolished when imposing a forced 5 s delay after each play, which hypothetically interrupted their dominant response set and increased their attention to negative feedback, thus enabling a better modulation of their responses (see Thompson & Corr, 2013, for a similar normalization of the response perseveration deficit in pathological gamblers). However, the only study aimed at analyzing the length of time that psychopaths paused after feedback in the CPT (Moltó et al., 2007) found that maladaptive response perseveration, as well as the impulsive/antisocial features of psychopathy predicting it, were associated to a lack of *overall* reflection (both after punishment and after reward). This finding is fully consistent with hypothesized impairments in frontocortical systems responsible for inhibitory control processes involved in the adequate regulation of the card-playing response, so that an impulsive (i.e., unreflective) response style would lead to maladaptive response perseveration (e.g., Moltó et al., 2007). It is less clear, however, the role that a lack of overall reflection or either an inability to reflect after negative feedback specifically would play in the perseverative style showed by children high on the affective/interpersonal features of psychopathy, since the amount of time participants reflect following feedback has not been routinely studied in past research.

In view of previous results, the current study sought to advance understanding about the contribution of trait fearlessness and externalizing proneness to maladaptive response perseveration in psychopathy by examining performance in the CPT in a mixed-gender sample of undergraduates who were assessed for psychopathy dimensions of boldness,

meanness and disinhibition. To date, the association between perseverative deficits and distinctive configurations of traits linked to psychopathy has mostly been studied within incarcerated or clinic-referred samples mainly composed of male participants, and findings have not been specifically replicated in samples of women (cf. Vitale & Newman, 2001). Extending research on this association in a non-institutionalized, mixed-gender sample could provide relevant insights to the etiological understanding of the full continuum of the psychopathy construct, as well as to the generalizability of psychopathy-linked deficits across gender. In addition, our approach within the framework of the triarchic model of psychopathy would allow to better disentangle potential differential contributions of the low fear (boldness, meanness) and the externalizing proneness (disinhibition) processes in predicting maladaptive response perseveration, given the close correspondence between the triarchic trait dimensions and the neurobehavioral constructs outlined in dual-process models of psychopathy (Patrick, 2018; Patrick & Bernat, 2009).

Thus, our main objectives were twofold: (1) to examine the differential contribution of triarchic psychopathy dimensions in predicting maladaptive response perseveration in the CPT and (2) to test for a potential mediating role of reflection following feedback in the associations found. Furthermore, correlations between triarchic dimensions and performance variables in the CPT were examined separately in men and women, in order to determine whether gender might modulate relationships between distinctive configurations of psychopathy traits and response perseveration deficits.

Method

Participants

A total of 222 unselected undergraduate students (142 women, 80 men; *M* age = 20.69, *SD* = 4.33), from the Universitat Jaume I of Castellón (Spain), were contacted by phone and agreed to participate in a laboratory-assessment procedure that included a

computerized adaptation of the Card Perseveration Task (CPT; Newman et al., 1987; Moltó et al., 2007), among other tasks that will be reported elsewhere. The research was approved by the Ethical Committee of the Universitat Jaume I. All participants were informed about the nature of the study, provided informed consent and received course credit or economic compensation for their participation. The Spanish adaptation (Poy, Segarra, Esteller, López, & Moltó, 2014) of the Triarchic Psychopathy Measure (TriPM; Patrick, 2010) was employed to assess psychopathic traits. The TriPM is a 58-item self-report measure developed to assess the three dispositional dimensions of boldness, meanness and disinhibition outlined in the triarchic model of psychopathy (Patrick et al., 2009). Items are answered using a 4-point Likert scale (3 = *true,* 2 = *somewhat true,* 1 = *somewhat false,* and 0 = *false*). Scores for each TriPM scale were computed as the sum of constituent items. TriPM scale scores can range from 0 to 57 for Boldness and Meanness (19 items) and from o to 60 for Disinhibition (20 items). In the current sample, Cronbach's alpha reliability coefficients for TriPM Boldness, TriPM Meanness, and TriPM Disinhibition scores were .85, .96, and .92, respectively. Previous work from our lab has demonstrated good convergent and discriminant validity of the Spanish adaptation of the TriPM scales in relation to other normal-range personality trait measures as well as to psychophysiological measures (Esteller, Poy, & Moltó, 2016; Poy et al., 2014; Ribes-Guardiola, Poy, Patrick, & Moltó, submitted).

Twenty participants (11 women, 9 men) showing an extremely conservative response style on the CPT —i.e., those who played less than 13 cards, thus receiving less than two punishments necessary to compute their mean response times after punishment feedback— were excluded to ensure that results reflected perseveration after establishing a response set for reward (see the next section); two additional participants (two men) were excluded because of extreme outlying response times following punishment (> 9 SDs). Excluded participants did not significantly differ from retained participants on any of the TriPM scale

scores, all *t*s < |1.5|, *ps* > .12. The final sample comprised a total of 200 participants (131 women, 69 men), with a mean age of 20.57 years (*SD* = 4.13).

Mean TriPM scale scores (and *SD*s) for men and women were 31.39 (9.24) and 25.84 (8.73) for TriPM Boldness, 13.94 (7.07) and 8.81 (5.16) for TriPM Meanness, and 16.99 (7.20) and 14.62 (7.13) for TriPM Disinhibition, respectively. Independent samples *t*-tests revealed that men scored significantly higher than women in all TriPM scales, *t*s (198) = 4.20, 5.86, and 2.23, *p*s < .0001, .0001 and .03, *d*s = 0.62, 0.83 and 0.33, respectively. Scores on the TriPM Boldness scale showed modest negative skewness values (Overall = -0.13; Women = -0.27; Men = -0.12), while scores on TriPM Meanness (Overall = 1.00; Women = 1.05; Men = 0.63) and TriPM Disinhibition (Overall = 0.54; Women = 0.71; Men = 0.28) scales showed positive skewness values, especially in women. Intercorrelations between scores on the three scales in the overall sample were .02 (*p* = .77) for TriPM Boldness with TriPM Disinhibition, .16 (*p* < .03) for TriPM Boldness with TriPM Meanness, and .50 (*p* < .0001) for TriPM Meanness with TriPM Disinhibition, and they did not significantly differ across gender, Fisher *r*-to-*z*s < |1.06|, *p*s > .28.

Card Perseveration Task

A computerized adaptation of the Card Perseveration Task (CPT; Newman et al., 1987; Moltó et al., 2007) was used to assess response perseveration. The software Presentation v.9.2 (Neurobehavioral Systems, Inc. Albany, CA, USA), installed in a PC HP workstation xw4600 computer was used to control the timing and presentation of stimuli and to record behavioral responses, executed via a Cedrus RB-730 response box. Participants performed the CPT in a soundproof room seated approximately at 1.5 meters of the screen monitor where the stimuli were displayed. Before starting the game, an experimenter entered into the room and read out loud the task instructions, which were also projected on the screen in front of the participant. The task comprised 100 Spanish cards, presented in a prearranged

order of face and number cards, so that the probability of winning (earn 10 euro cents) was 0.90 in the first block of 10 cards. This probability decreased linearly by 0.10 in each successive block of 10 cards until the last block, where the probability of earning money was 0. Participants were informed that the game did not involve a conventional deck of cards, so they could not know how many face or number cards would appear or how many cards there were in the deck. Participants were also informed that they could not pass on cards: they could only choose either to play the next card or to quit the game at any time. They were not told that the computer was recording the length of time between the feedback and the next response (i.e., response times after reward and punishment feedback).

At the beginning of the task, the back side of a card appeared on the center of the screen on a black background along with two stacks of 50 coins each, one to the right of the card, and the other to the left. Participants were told that the stack of coins they saw in the left side was composed of 50 coins of 10 euro cents, 20 belonging to them and 30 borrowed to start the game. The group of 50 coins they saw on the right represented the amount of money they could potentially win. Each trial started with the words “Do you want to play?” over the backside of the card appearing on the center of the screen. After each play, the question disappeared, the reverse side card was replaced with a face card or a number card, and immediate visual, auditory, and monetary feedback were presented for 1000 ms. Face cards were accompanied by the words “YOU WIN!”, a high tone, and the left stack increased in 10 euro cents; number cards were accompanied by the words “YOU LOSE!”, a low tone, and the left stack decreased in 10 euro cents. Immediately after feedback the backside of a card appeared again on the center of the screen along with the question “Do you want to play?”.

To maximize earnings in the CPT, participants should play at least during the first four blocks of 10 cards —where the card-playing response is still more rewarded than punished— and then quit at some point between the next two blocks —those with maximum uncertainty,

where the card-playing response starts to become equally punished and rewarded. Perseveration occurs when participants fail to shift to this implicit rule, and individual differences before this critical point are not likely to be a function of perseveration (cf. Moltó et al., 2007; see also Séguin et al., 2002).

Statistical analyses

Pearson's *r* correlations were used to explore the relationships between response times after reward and punishment feedback and maladaptive response perseveration on the CPT (i.e., the number of cards played and the amount of money earned), as well as to examine bivariate relationships between TriPM scale scores and dependent variables in the task. Partial correlation analyses were conducted to evaluate the unique contribution of each triarchic dimension on response perseveration, after controlling for the overlap with the other triarchic dimensions. These relationships were examined for the overall sample and for women and men separately, given previously reported inconsistencies between samples of incarcerated men and women on the relationships between psychopathic dimensions and performance on the CPT (see Moltó et al., 2007; Newman et al., 1987; Vitale & Newman, 2001). As a final set of analyses, and based on the hypothesized role that a lack of reflection may play in explaining maladaptive response perseveration (e.g., Newman et al., 1987; Moltó et al., 2007), we also examined whether response times after reward and punishment feedback mediated the effects of psychopathic trait dimensions in predicting the number of cards played and the amount of earnings by means of bootstrapped parallel multiple mediation analyses using PROCESS (Hayes, 2013).

Results

Performance on the CPT

Descriptive statistics for the CPT performance measures in the final study sample, and for women and men separately, are shown in Table 1. Independent samples *t*-tests revealed no significant gender differences on any dependent measure on the CPT.

Figure 1A shows a density graph (i.e., the darker the line, the more data points — number of participants) illustrating the relationship between the number of cards played and the amount of money earned throughout the task for the current study sample. As evidenced in the graph, most participants exhibited an optimal response strategy —stopping around 30-60 cards played, thus maximizing the amount of money earned—, while a smaller group of participants exhibited a perseverative response strategy —i.e., playing approximately until the end of the game and winning less money, as illustrated by the darker area in the lower right side of Figure 1A. In this regard, our results conformed nicely with the 75 cards cut-off employed in some studies as a threshold to define response perseveration (cf. Séguin et al., 2002). As a complement to the continuous analyses, we also conducted performance-based group analyses by grouping participants according to their response style in the task using this cut-off[1], and tested for significant differences on their TriPM scale scores.

The number of cards played was inversely related to the mean response times after punishment and after reward, *r*s (200) = -.33, and -.39, *p*s < .0001, respectively. Similarly, the

[1] The 25% of our sample evidenced maladaptive response perseveration as defined by the 75 cards cut-off (75th percentile = 74.75 cards played). Proportions of women and men exceeding this threshold were not significantly different (25.19% vs. 24.64%, respectively: $\chi^2 = 0.01$, df = 1, $p = .93$). Participants in the Optimal response strategy group ($n = 150$) and in the Perseverative response strategy group ($n = 50$) significantly differed in the amount of money earned (Optimal: $M = 3.73$ euros, $SD = 0.30$ vs. Perseverative: $M = 1.68$ euros, $SD = 0.80$, $t(198) = 26.44$, $p < .0001$, $d = 3.93$) and in their mean response times following reward (Optimal: $M = 1080.12$ ms, $SD = 574.27$ vs. Perseverative: $M = 734.10$ ms, $SD = 439.44$, $t(198) = 3.89$, $p < .0001$, $d = 0.68$), and punishment feedback (Optimal: $M = 713.26$ ms, $SD = 328.61$ vs. Perseverative: $M = 539.54$ ms, $SD = 271.23$, $t(198) = 3.37$, $p < .001$, $d = 0.58$).

amount of money earned was positively associated with both mean response times, *r*s (200) = .19 and .22, *p*s < .01, respectively. This pattern of results is consistent with previously reported findings in incarcerated men (cf. Moltó et al., 2007), and indicates that a lack of overall reflection might constitute a factor contributing to maladaptive response perseveration in this task.

Triarchic dimensions and performance on the CPT

As can be seen in Table 2, TriPM Boldness scale scores were significantly and positively related to the number of cards played and negatively related to the amount of money earned on the CPT, indicative of maladaptive response perseveration. These relationships were significant across participants overall and within gender subgroups and remained significant even after controlling for its overlap with TriPM Meanness and TriPM Disinhibition scale scores in partial correlation analyses (see Table 2). No significant correlations emerged for TriPM Disinhibition or TriPM Meanness scale scores. Likewise, as illustrated in Figure 1B, performance-based group analyses revealed that participants showing a Perseverative response strategy scored significantly higher than those showing an Optimal response strategy only in TriPM Boldness (Perseverative: $M = 32.1$, $SD = 9.44$; Optimal: $M = 26.31$, $SD = 8.78$, $t\ (198) = 3.97$, $p < .0001$, $d = 0.64$), but not in TriPM Meanness (Perseverative: $M = 11.38$, $SD = 6.67$; Optimal: $M = 10.31$, $SD = 6.26$, $t\ (198) = 1.03$, $p = .31$) nor TriPM Disinhibition scales[2] (Perseverative: $M = 15.96$, $SD = 7.43$; Optimal: $M = 15.26$, $SD = 7.17$, $t\ (198) = 0.59$, $p = .55$).

Mediation of response perseveration by response times following feedback

[2] The same pattern of results was found when performance-based group analyses were conducted within gender subgroups separately, with significant differences only for TriPM Boldness scores ($t = 3.46$, $p < .001$, $d = 0.70$ for women; $t = 2.32$, $p < .03$, $d = 0.60$ for men), but not for TriPM Meanness nor TriPM Disinhibition scores (ts < |1.14|, ps > .25 for women; ts < |0.47|, ps > .63 for men).

To further examine the role of response times after feedback on the perseverative deficits shown by participants scoring high in boldness[3], two parallel multiple mediation bootstrapped analyses were ran using the PROCESS macro for SPSS (Model 4; Hayes, 2013; Preacher & Hayes, 2008) for the overall sample[4]. We tested for direct effects of TriPM Boldness scale scores (i.e., after accounting for response times after feedback) on the number of cards played (Model 1) and the amount of money earned (Model 2), as well as for significant total and specific indirect effects of TriPM Boldness scale scores on maladaptive response perseveration through response times after reward (M_1) and punishment (M_2) feedback. All models were based on 5,000 resamples, producing bias-corrected 95% confidence intervals (CIs). Evidence for statistically significant indirect effects are indicated when 95% bias corrected bootstrap CIs do not include zero (Hayes, 2013). Results from this set of analyses are summarized in Table 3, and only revealed significant direct effects of TriPM Boldness scale scores on both the number of cards played and the amount of money earned. Neither total nor specific indirect effects for response times after feedback were found to be significantly different from zero, which ruled out the possibility of an effect of TriPM

[3] Correlational analyses in the sample as a whole revealed no unique associations between TriPM Boldness scale scores and response times after punishment or after reward feedback, partial *r*s = -.10 and -.07, *p*s = .09 and .26, respectively. Examining gender subgroups separately, TriPM Boldness scores were significantly related to response times after punishment feedback in women (partial $r = -.18$, $p < .05$), but not in men (partial $r = -.09$, $p = .48$); corresponding correlations with response times after reward feedback were nonsignificant, partial *r*s = -.11 and -.03, *ps* = .18 and .81, respectively. TriPM Meanness and TriPM Disinhibition scores did not correlate uniquely with response times after punishment and after reward in the overall sample (partial *r*s < |.09|, *p*s > .20) or in either gender subgroup (partial *r*s < |.17|, *p*s > .17).

[4] As the correlations between TriPM Boldness scale scores and response times after feedback did not significantly differ across gender, Fisher *r*-to-*z*s < |.61|, *p*s > .54, only the mediation analyses for the overall sample are reported here. Mediation analyses conducted for women and men separately yielded the same pattern of results.

Boldness scale scores on maladaptive response perseveration through reflection time after feedback in this sample.

Discussion

The present study found evidence for a role of the boldness dimension of the triarchic model of psychopathy in predicting maladaptive response perseveration in the CPT in both women and men. As conceptualized in the triarchic model, boldness constitutes one phenotypic disposition in which a fearless temperament can be expressed, marked by high levels of social dominance, immunity to stressful events, and venturesomeness (Patrick et al., 2009). Key referents for boldness include prominent accounts of psychopathy such as the low fear (Lykken, 1957, 1995) or the weak behavioral inhibition hypotheses (Fowles, 1980), both of which have highlighted the role of an absence of fear of punishment in inhibiting reward approach behavior as a defining feature of the disorder. A similar construct of low-fear/trait fearlessness —reflecting an underactivity of the brain's defensive motivational system— is also proposed by dual-process models of psychopathy (Patrick & Bernat, 2009) as relevant to understand the affective/interpersonal features of the disorder, represented in the boldness and meanness dimensions in the triarchic model (Patrick et al., 2009).

Congruently, one plausible explanation for the current findings is that participants high in boldness may have showed a failure in the interruption of the card-playing response because of their insensitivity to punishment cues. This interpretation is reinforced by research in community/undergraduate samples —such as the one employed here— demonstrating associations between boldness-related traits and diverse psychophysiological indicators of low fear, including deficient aversive startle potentiation (Esteller, Poy, & Moltó, 2016; Vaidyanathan, Patrick, & Bernat, 2009), deficient fear conditioning (López, Poy, Patrick, & Moltó, 2013), and reduced skin conductance reactivity during anticipation of aversive stimuli (Dindo & Fowles, 2011). Thus, our results showed that boldness is also associated with a

form of reward-seeking behavior that is not restrained by the progressive increase in punishment contingencies, probably due to an absence of fear or insensitivity to punishment cues.

Alternatively, our findings could also be interpreted within the response modulation hypothesis of psychopathy (Hamilton & Newman, 2018). However, the response modulation hypothesis constitutes a unitary etiological model of psychopathy and a close correspondence between response modulation deficits and boldness vs. other psychopathic traits from a multifaceted construct perspective is in need of further clarification (e.g., Smith & Lilienfeld, 2015). Moreover, the perseverative deficits linked to the boldness dimension of psychopathy are not likely to stem from difficulties to pause and reflect enough on performance feedback, as the response modulation hypothesis would predict. Our mediation analyses did not evidence significant indirect effects of boldness on maladaptive response perseveration through reflection times. Rather, our results point out to the possibility that participants scoring high in boldness might have just evaluated the increase of punishment contingencies as less threatening, thus being more willing to take risks and play longer than those scoring low (e.g., Lykken, 1995). This in turn would be consistent with recent evidence relating boldness specifically to higher levels of sensation seeking (Weidacker, O'Farrell, Gray, Johnston, & Snowden, 2017), and to laboratory measures of risk taking resulting in adverse outcomes (Snowden, Smith, & Gray, 2017). Collectively, our results dovetail well with theoretical proposals suggesting that the form of 'disinhibited' behavior linked to the affective/interpersonal features of psychopathy might be more related to a willingness to take risks, as opposed to the more reckless, unreflective manifestations of impulsivity (Fowles & Dindo, 2006; see also Poythress & Hall, 2011).

The evidence for the role of boldness in predicting maladaptive response perseveration departs from past research in various aspects. On the one hand, our results might seem

somewhat inconsistent with results showing a reward-dominant response style on variants of the CPT adapted to children linked to the CU traits of psychopathy (e.g., Barry et al., 2000; Frick et al., 2003; O'Brien & Frick, 1996), which are represented in the meanness —but not in the boldness— dimension in the triarchic model (Patrick et al., 2009). However, dispositional fearlessness has been proposed to contribute to both clusters of affective/interpersonal psychopathic features (Patrick & Bernat, 2009; Patrick et al., 2009). In this regard, differences in sample characteristics —community and clinic-referred youths vs. undergraduate young adults in the present study—, together with the limited coverage of boldness characteristics in youth psychopathy inventories (e.g., Drislane, Patrick, & Arsal, 2014) could also account for the different clusters of affective/interpersonal features of psychopathy associated with maladaptive response perseveration in present and past research.

On the other hand, in relation to previous evidence within incarcerated adult samples, the only previous study which examined the differential contribution of PCL-R-assessed psychopathic traits found maladaptive response perseveration to be associated with the impulsive/antisocial (disinhibition) traits, but not with the affective/interpersonal features of psychopathy (Moltó et al., 2007). Thus, our results did not replicate in an undergraduate mixed-gender sample the same links between specific configurations of psychopathic traits and maladaptive response perseveration found in incarcerated men. One potential explanation for these discrepancies could be related to the relative incentive value of the task itself in incarcerated vs. community/undergraduate samples, with the task being (hypothetically) more stimulating for incarcerated participants and thus more suitable to elicit disinhibited (i.e., impulsive/unreflective) reward seeking behavior in such contexts (e.g., Belmore & Quinsey, 1994). It could also be the case that monetary contingencies might differentially impact performance of undergraduate vs. incarcerated participants, thus allowing for the emergence of boldness-related differences in perseverative behavior linked to insensitivity to punishment in our sample. However, these explanations are speculative and future studies conducted in

both incarcerated and community samples could aim to include ratings of monetary/task incentive value to better test for this assumption.

Another aspect to be considered is that the PCL-R assessment of psychopathy only provides limited coverage of boldness-related traits through its interpersonal facet (Patrick et al., 2019), and thus the role of this triarchic dimension in past research examining maladaptive response perseveration in incarcerated populations may have been obscured, especially in studies working from a unitary construct perspective. Otherwise, from a multifaceted conceptualization of psychopathy within the triarchic model framework, it could also be posited that processes of externalizing vulnerability and trait fearlessness can contribute differentially to perseverative deficits in criminal and in noncriminal samples, where differential emphasis on disinhibition, meanness and boldness are placed (cf. Patrick et al., 2009). In this vein, externalizing vulnerability might be presumably more relevant in criminal contexts —with psychopathy entailing a conjunction of disinhibition with meanness more so than boldness—, in light of the impulsive/unreflective response style that seems to drive relationships between the impulsive/antisocial traits and maladaptive response perseveration among incarcerated men (Moltó et al., 2007). Hypothetical lower disinhibition levels in incarcerated women would explain the lack of replication of similar links between PCL-R-assessed psychopathy and response perseveration across gender (cf. Newman et al., 1987 vs. Vitale & Newman, 2001). Conversely, trait fearlessness would have a prevailing role in successful contexts —with psychopathy encompassing predominantly boldness along with disinhibition—, as suggested by boldness-related perseverative deficits (unmediated by reflection) for both women and men in our undergraduate sample. Further, such mechanism leading to disinhibited behavior through low dispositional fear (that is, an insensitivity to punishment cues) appears not to be modulated by gender. Future research could attempt to test for the relevance of both processes by examining laboratory-based measures of behavioral

disinhibition in relation to distinctive configurations of psychopathy traits in different populations.

Work along these lines could be especially relevant to pursue within the triarchic model framework, as its facet constructs correspond to biobehavioral dispositions with increasingly well-established correlates in multiple measurement domains, such as threat sensitivity (Yancey, Venables, & Patrick, 2016), callousness (Brislin et al., 2018), and inhibitory control (Venables et al., 2018) (see Patrick, 2018; Patrick & Drislane, 2015). In this regard, studies conducted from a multi-method measurement approach (see Patrick, Iacono, & Venables, 2019) would be particularly important to understand the extent to which tasks such as the CPT index processes in common with other tasks assessing defensive (fear) reactivity —more relevant to boldness; e.g., startle potentiation (Esteller et al., 2016), fear conditioning (López et al., 2013), or aversive countdown tasks (Dindo & Fowles, 2011)— versus inhibitory control capacity —more relevant to disinhibition; e.g., stop-signal, stroop interference, antisaccade tasks; see Venables et al., 2018).

Findings from the current study must be considered in light of some limitations, such as the use of a homogeneous undergraduate sample that might have restricted the full range of triarchic psychopathy scores, potentially attenuating some effects for other triarchic dimensions. As such, our results would need to be replicated in larger samples more heterogeneous in age and educational level ensuring a wider representation of triarchic psychopathy scores, which could also be accomplished by pre-screening participants on triarchic psychopathy scores. Relatedly, extending our results to adult offender and clinic-referred children and adolescents within the triarchic model framework will constitute an important step in establishing the generalizability of our findings. This would be especially relevant since the role of boldness in the nomological network of psychopathy has generated substantial controversy (see Lilienfeld et al., 2012; Marcus, Fulton, & Edens, 2013; Miller &

Lynam, 2012), especially in light of evidence relating boldness to some forms of adaptive functioning (Miller & Lynam, 2012; Lynam & Miller, 2012). At least within the context of this laboratory task, higher levels of boldness were related to difficulties in suspending reward-approach behavior in the face of increasing punishment contingencies, resulting in maladaptive outcomes. Demonstrating that boldness-related traits can predict deficits on laboratory tasks designed to examine behavioral regulation deficits under punishment and reward contingencies —which have had strong influence in theorizing about emotional and cognitive deficits underlying psychopathic personality (e.g., Lykken, 1957, 1995; Newman, 1998; Patrick & Bernat, 2009)— could be an important step in future research that would help to gauge its relevance to the nomological network of psychopathy.

In this regard, our results highlight the usefulness of the triarchic model framework in identifying laboratory correlates of distinct features of psychopathy, potentially helping to advance our understanding of the different etiological pathways contributing to the varying manifestations of this personality disorder.

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Table 1. *CPT performance measures means (M) and standard deviations (SD) for participants in the final experimental sample.*

	All participants (N = 200)		Women (N = 131)		Men (*n* = 69)		Gender comparison	
	M	*SD*	*M*	*SD*	*M*	*SD*	*t*	*p*
Number of cards played	58.77	24.47	57.79	24.29	60.62	24.88	-0.78	.44
Amount of money earned (euro)	3.22	1.01	3.26	0.97	3.15	1.07	0.74	.46
Response time after punishment (ms)	669	323	656	295	696	371	-0.83	.41
Response time after reward (ms)	993	563	979	534	1021	616	-0.49	.62

Note. All comparisons between response times after punishment and after reward are significant at $p < .0001$.

Table 2. *Correlations between TriPM scale scores and the number of cards played and the amount of money earned on the CPT for the overall sample (n = 200), and for women (n = 131) and men (n = 69) separately.*

	Number of cards played			Amount of money earned		
	Overall	Women	Men	Overall	Women	Men
TriPM Boldness	.26***/ .26***	.25**/ .25**	.26* / .25*	-.25*** /-.24***	-.23**/ -.22*	-.28*/ -.28*
TriPM Meanness	.04/ .02	.04/ -.01	-.02/ .11	-.10 / -.03	-.10/ -.03	-.06/ -.08
TriPM Disinhibition	-.03/ -.04	.05/ .05	-.19/ -.20	-.06 / -.03	-.09/ -.07	.01/ .03

Notes: Values to the left of the slash are for zero-order correlations; values to the right of the slash are partial correlations for each TriPM scale score controlling for the overlap with the other two TriPM scales scores. TriPM = Triarchic Psychopathy Measure.

*** $p < .001$; ** $p < .01$; * $p < .05$

Table 3: *Point estimates [95% Confidence Intervals] from the parallel multiple mediation models of the relationship between TriPM Boldness scores and the CPT dependent variables (DVs), with response times after reward and punishment feedback as mediators.*

	Direct effect [95% CI]	Total indirect effect [95% CI]	Specific indirect effect [95% CI]	
CPT DVs			Response times after reward	Response times after punishment
Number of cards played	**0.6017 [0.2688, 0.9346]**	0.0847 [-0.0563, 0.2423]	0.0737 [-0.0547, 0.2365]	0.0110 [-0.0677, 0.0875]
Amount of money earned	**-0.0252 [-0.0398, -0.0106]**	-0.0019 [-0.0059, 0.0016]	-0.0016 [-0.0058, 0.0012]	-0.0002 [-0.0029, 0.0027]

Note: Bold entries denote significant effects ($p < .001$); CI = confidence interval.

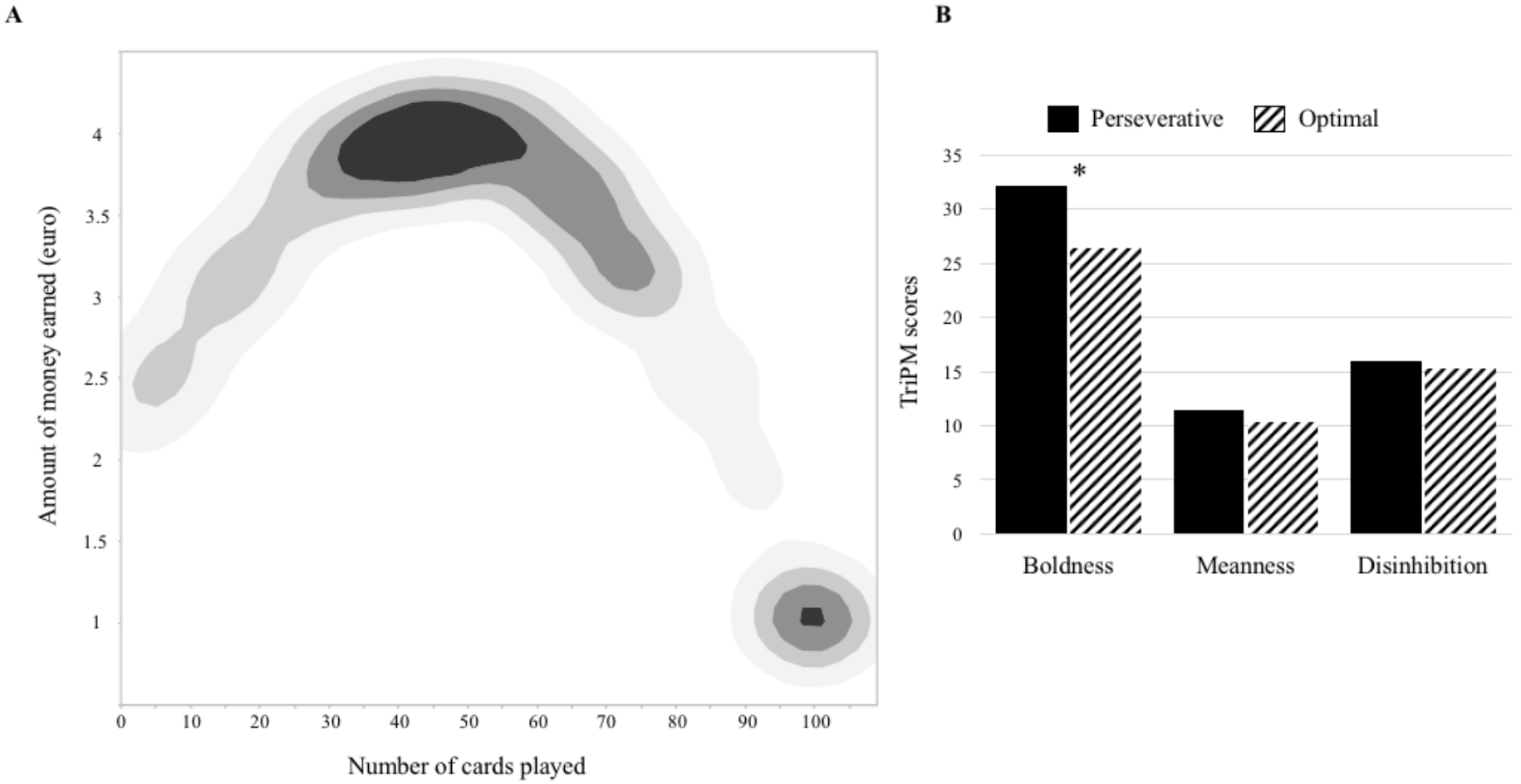
A
Amount of money earned (euro)
4
3.5
3
2.5
2
1.5
1
0
10
20
30
40
50
60
70
80
90
100
Number of cards played
B
Perseverative
Optimal
TriPM scores
35
30
25
20
15
10
5
0
*
Boldness
Meanness
Disinhibition

Figure 1: (A) Density graph illustrating the frequencies of observations (i.e., the number of participants) within the space defined by the amount of money earned and the number of cards played. The darker the line, the greater the number of participants. (B) Mean TriPM scale scores for participants showing a Perseverative response strategy and an Optimal response strategy on the CPT.